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PROVISIONAL APPLICATION FOR PATENT COVER SHEET

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☐ *Additional inventors are being named on the _____ separately numbered sheets attached hereto*

TITLE OF THE INVENTION (500 characters max)

QoS SUPPORT IN CDMA2000 R-P NETWORK

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ENCLOSED APPLICATION PARTS *(check all that apply)*

☑ Specification *Number of Pages* 6
☑ Drawing(s) *Number of Sheets* 4
☐ Application Data Sheet. See 37 CFR 1.76
☐ CD(s), Number
☑ Other (specify) Appendix 6 pgs Abstract 1pg Postcard Certification 1 pg

METHOD OF PAYMENT OF FILING FEES FOR THIS PROVISIONAL APPLICATION FOR PATENT

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Respectfully submitted,

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Date 8-6-03

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USE ONLY FOR FILING A PROVISIONAL APPLICATION FOR PATENT

PROVISIONAL APPLICATION COVER SHEET
Additional Page

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Date 8/6/03

QoS SUPPORT IN CDMA2000 R-P NETWORK

BACKGROUND OF THE INVENTION

[0001] Without limiting the scope of the invention, its background is described in connection with network architectures that prioritize data according to type.

[0002] The differentiated services (DiffServ) architecture described in RFC2475 is based on a simple model where traffic entering a network is classified and possibly conditioned (e.g., marked, metered, policed, shaped) at the boundaries of the network (i.e., at the edge router), and assigned to different behavior aggregates. Each behavior aggregate is identified by a single Differentiated Services Code Point (DSCP). Within the core of the network, packets are forwarded according to the per-hop behavior associated with the DSCP. Therefore, with the DiffServ architecture, the complexity is pushed into the edge of the network, while keeping the core routers simple.

[0003] The edge routers in a DiffServ domain are also termed as ingress node or egress node, depending on the traffic direction. In a typical CDMA2000/3GPP2 network as shown in Figure 1, the Radio Node (RN), e.g. BTS is the ingress node for the uplink traffic, while the Packet Data Switching Node (PDSN) is the ingress node for the downlink traffic. In order to provide the DiffServ based QoS inside the R-P network (i.e., the IP network connecting RN and PDSN), the DiffServ functionality for the edge router, such as packet classification, marking, metering, policing and shaping should be implemented in RN and PDSN. In order to perform these functions, all the Qaulity of Service (QoS) related information needs to be properly relayed/configured into RN and PDSN. However, as described in section 2, the current 3GPP2 specification doesn't fully support such functionality.

[0004] In the current 3GPP2 standardization [3GPP2 P.S0001 C.4], flow mapping and treatment is originally introduced to map a particular downlink flow to a service instance. As described in 3GPP2 specification [3GPP2 P. S0001], in addition to a main service instance, a MN may open one or more auxiliary service instances to carry traffic that is not suitable for the main service instance. In order to effectively use the auxiliary service instance, the PDSN needs to be informed about the packet filters (i.e., the information used by the PDSN to classify which packet to be sent on which service instance).

[0005] The mechanism to support DiffServ QoS in R-P network and external network has not been clearly defined in the current 3GPP2 standardization. The flow mapping mechanism described above can only be used to map a downlink traffic flow to a particular

auxiliary service instance, however, the mechanism for PDSN to obtain the QoS requirement of the flows inside an auxiliary service instance hasn't been defined. Although [TR45: Interoperability Specification (IOS) for cdma200 Access Network Interfaces – Part 2 Transport", PN-4545.2-RV3, Ballot Version October 2002] also stated that RAN policies or local policies defined by service provider can be used by RN and PDSN to mark and condition the uplink and downlink traffic, the mechanism for RN and PDSN to obtain the QoS requirement of the flows in order to apply the policy are not defined at all.

[0006] As may be seen, an improved mechanism to improve functionality between two network nodes could provide an improved network architecture.

FIELD OF THE INVENTION

[0007] The present invention relates, in general, to prioritization of data between network nodes; and, in particular, to a method and system for establishing prioritization requirements between network nodes.

BRIEF SUMMARY OF THE INVENTION

[0008] The present invention presents an improved method and system for enabling traffic flow management between two nodes.

[0009] This invention report proposes several approaches to provide DiffServ support to both uplink and downlink traffic over the R-P network and external network. In order for RN and PDSN to provide QoS and/or enforce QoS polices, they need to obtain the QoS requirement from the mobile node. This invention report to signal such QoS requirement at the link level using QoS_BLOB information or at the IP level via an extended dynamic flow mapping mechanism. This invention report also proposes how to use these QoS information at RN and PDSN to provide QoS support to the R-P network and external network.

BRIEF DESCRIPTION OF THE DRAWINGS

[00010] For a more complete understanding of the present invention, including its features and advantages, reference is made to the detailed description of the invention, taken in conjunction with the accompanying drawings of which:

[00011] FIG. 1 DiffServ Domains in 3GPP2 Network System;

[00012] FIG. 2 Flow Mapping and DiffServ Conditioning for Downlink Traffic: Solution 1;

[00013] FIG. 3 Flow Mapping and DiffServ Conditioning for Downlink Traffic: Solution 2;

[00014] FIG. 4 Flow Mapping and DiffServ Conditioning for Uplink Traffic: Solution 1;

[00015] FIG. 5 Flow Mapping and DiffServ Conditioning for Uplink Traffic: Solution 2;

[00016] FIG. 6 Flow Mapping and DiffServ Conditioning for Uplink Traffic: Solution 3; and

[00017] FIG. 7 Integration of Solution2/uplink and Solution 2/downlink

DETAILED DESCRIPTION OF THE INVENTION

[00018] While the use and implementation of particular embodiments of the present invention are presented in detail below, it will be understood that the present invention provides many inventive concepts which can be embodied in a wide variety of contexts. The specific embodiments discussed herein are mere illustrations of specific ways for making and using the invention and are not intended to limit the scope of the invention.

[00019] Appendix: Hereby incorporated by reference is an attached contribution by Nokia to a 3rd Generation Project 2 "3GPP2" standards body titled "Nokia Procedures for Supporting End-to-End QoS in the 3GPP2 System".

[00020] A modified RSVP RESV message is used by the MS to signal one or more packet filters, called Traffic Flow Templates (TFT). The TFTs are only used to map downlink traffic to auxiliary service instance. The TFT IE, RESV message and protocol operation of dynamic flow mapping in downlink direction are described in [3GPP2 P. S0001] and will not be repeated in this document. The mechanism defined for flow mapping can be easily extended to provide QoS support to both uplink and downlink traffic over R-P bearer and external network. The QoS support defined here is DiffServ support and requires R-P network and external network to be DiffServ capable. Some approaches proposed in this invention report extend the service mapping mechanism to support DiffServ QoS in R-P and external networks.

[00021] The QoS_BLOB defined in [TIA/IS-707-A-3] is used by the MN to signal the RN its QoS requirement for both uplink and downlink traffic. (Although QoS_BLOB is currently only defined in service option 33, it can be used for other type of service option as well.) Based on the QoS_BLOB, RN provides correspondent QoS over the air interface. However, no QoS support is defined for downlink traffic over the R-P connection. Although the downlink traffic coming into the PDSN from the external network could be marked with DSCP, PDSN may need to remark the packet based on downlink QoS requirement from the MN, user subscription policy (e.g., bandwidth limitation for a particular session) and other local network policy. In order for PDSN to mark the downlink traffic correctly based on its QoS requirements, besides the TFT of

the flow, the QoS requirements of the flow need to be signaled to the PDSN as well. Two solutions are listed below.

[00022] Solution 1: RN sends downlink QoS information to PDSN - The basic idea of this approach is that RN obtains or derives the QoS requirement from the QoS_BLOB and then sends the QoS requirement to PDSN. This requires modification to the A11 interface to carry the QoS requirement of the downlink traffic.

[00023] As shown in Figure 2, if MOB_QoS is set, the MN sends OM/EOM message with QoS_BLOB to the RN; otherwise, RN initiates the service negotiation or service option negotiation procedure, which carries the QoS_BLOB. Regardless of the procedure used, after obtaining the QoS_BLOB, RN sends the **QoS information** to the PDSN in an A11 message. Such A11 message could be a modified A11 RRQ message. (The modification to the existing interface and procedures in different network entities are shown in bold). The **QoS information** could be in the format of QoS_BLOB or RSVP FLOWSPEC or other QoS parameters. The PDSN obtains the downlink QoS requirement from the **QoS information** carried in A11 message and then decides what DiffServ policies to be applied, based on local network policy and the user subscription profile. The DiffServ policies could include, but are not limited to, DSCP marking and traffic policing/shaping policies. The definition of these policies is subject to different service providers and is not within the scope of this document. Only two examples of the DiffServ policies are given below.

[00024] Example1 – DiffServ marking policy: The downlink traffic with QoS information with a requirement of requested bandwidth x bps, requested maximum delay y ms, and acceptable loss rate z%, will be marked with DSCP d1.

[00025] Example2 – traffic policing/shaping policy: The streaming application (specified by Traffic_Class or Application ID) used by a Gold user (high priority) should not exceed X bps during busy hour. Such policy could be specified in user QoS profile or defined by local network. Although the RN is aware of those policies, instead of possibly overloading R-P network, the PDSN can enforce the policies already to downlink traffic by dropping or shaping the out-of-profile traffic based on such a policy.

[00026] After the DiffServ polices (e.g., DSCP used for the flows mapped to the service instance identified by the SR_ID) are decided based on the QoS information for the service instance, they are mapped with the correspondent SR_ID. The PDSN then responds to the RN with A11 message, such as A11 RRP message. In addition, in order for PDSN to map the downlink traffic into the correct service instance, the MN signals the TFT for the downlink traffic to the PDSN as defined in current CDMA2000 specification. When downlink traffic passes the

PDSN, the PDSN first maps the packets into the correct service instance based on the TFT, and then marks the packet with the correct DSCP associated with the SR_ID. Other possible DiffServ functions (e.g., policing, shaping) can be performed as well.

[00027] Solution 2: MS sends downlink QoS requirement to PDSN

[00028] The basic idea, as shown in Figure 3, is to signal the QoS requirements of the downlink traffic along with the TFT in the RESV message from the MN to the PDSN. The QoS requirement carried in the RESV message could still be the QoS_BLOB or a new information element or the FLOWSPEC defined for standard RSVP. After receiving the RESV message, the PDSN decides the DiffServ policy to be applied, based on the QoS requirement for the downlink traffic and creates the mapping between TFT, SR_ID and DiffServ policy (as described for solution 1).

[00029] The traffic handling procedure is the same as the ones defined in solution 1.

[00030] 5.2 Uplink Traffic

[00031] In the current CDMA2000 specification, uplink QoS requirement can be carried in the QoS_BLOB and signaled between MN and RN. However, it is not specified how QoS is provided for the uplink traffic passing through the RN toward the PDSN and then to the external networks. In order to provide QoS support beyond the RN, the RN needs to be informed of the QoS requirements of the uplink traffic and it has to apply the correspondent DiffServ traffic handling policies. Three solutions are described below.

[00032] Solution1: Mapping from QoS_BLOB to DSCP - The basic idea of this approach is to directly map QoS_BLOB into DiffServ DSCP and other diffsev policies. As shown in Figure 4, after obtaining QoS_BLOB for the service instance, based on the QoS requirement carried in the QoS_BLOB, the RN decides which DiffServ policies (DSCP marking) are to be applied to the service instance, then establishes the mapping between SR_ID and DiffServ policy (e.g., DSCP).

[00033] Solution 2: Mapping instructed by PDSN - The basic idea is to carry the QoS requirement for the uplink traffic in the RESV message, which is used to signal flow mapping in the current CDMA2000 specification. As shown in Figure 5, after receiving the uplink QoS requirement in the RESV message from MN, the PDSN decides which DiffServ policy (e.g., DSCP) is used for uplink traffic based on the QoS requirement. The QoS requirements sent in the RESV message could be in the QoS_BLOB format, or in the RSVP FLOWSPEC format, or a new information element standardized in 3GPP2 or other forum. After creating the mapping between SR_ID and DiffServ policy, the PDSN not only configures it locally but also pushes the

uplink traffic handling policy into the RN. The protocol used by PDSN to push the DiffServ policy for the uplink traffic could be COPS or modified A11 messages. Only COPS messages are illustrated in Figure 5.

[00034] Solution 3: Mapping at RN via interception of RESV message - As shown in Figure 6, this approach is similar to Solution 2, where uplink QoS requirements are carried in the RESV messages. However, when the RESV message reaches the RN, the RN intercepts the message and extracts the SR_ID and uplink QoS requirements, and then decides on the DiffServ policy and configures the policy locally. If the RESV message only carries the uplink QoS requirement, which is not needed for PDSN, RN can terminate the RESV message and sends the RESV_CONF message back to MN. Otherwise, RN forwards the RESV message toward the PDSN. The PDSN ignores the uplink QoS requirement information carried in the RESV message, and only processes the downlink part if exists.

[00035] 5.3 Integrated Solution for Uplink and Downlink Traffic

[00036] Although the solutions for uplink traffic and downlink traffic are documented separately, the correspondent solutions can be merged together. For example, when solution2 for downlink traffic and solution 2 for uplink traffic are merged, the integrated solution is illustrated in Figure 7. Other combinations are also possible and are not illustrated in this document.

[00037] While this invention has been described with reference to particular embodiments, this description is not intended to be limiting. Various modifications and combinations of the illustrative embodiments, as well as other embodiments of the invention, will be apparent to persons skilled in the art. It is, therefore, intended that the appended claims encompass any such modifications or embodiments.

ABSTRACT OF THE DISCLOSURE

This invention report proposes several approaches to provide DiffServ support to both uplink and downlink traffic over the R-P network and external network. In order for RN and PDSN to provide QoS and/or enforce QoS policies, they need to obtain the QoS requirement from the mobile node. This invention report to signal such QoS requirement at the link level using QoS_BLOB information or at the IP level via an extended dynamic flow mapping mechanism. This invention report also proposes how to use these QoS information at RN and PDSN to provide Qos support to the R-P network and external network.

QoS SUPPORT IN CDMA2000 R-P NETWORK
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NC37291

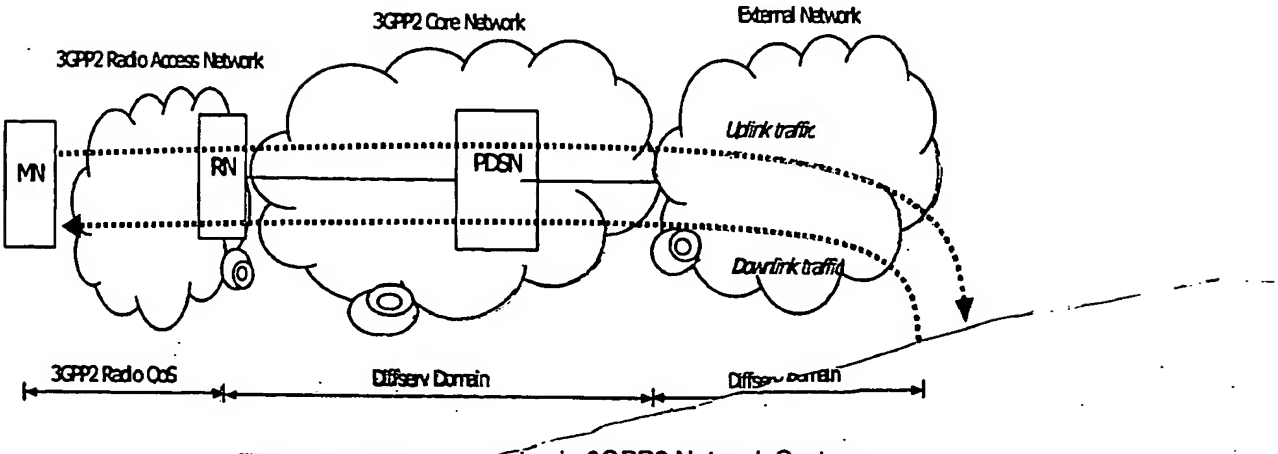

Figure 1. DiffServ Domains in 3GPP2 Network System

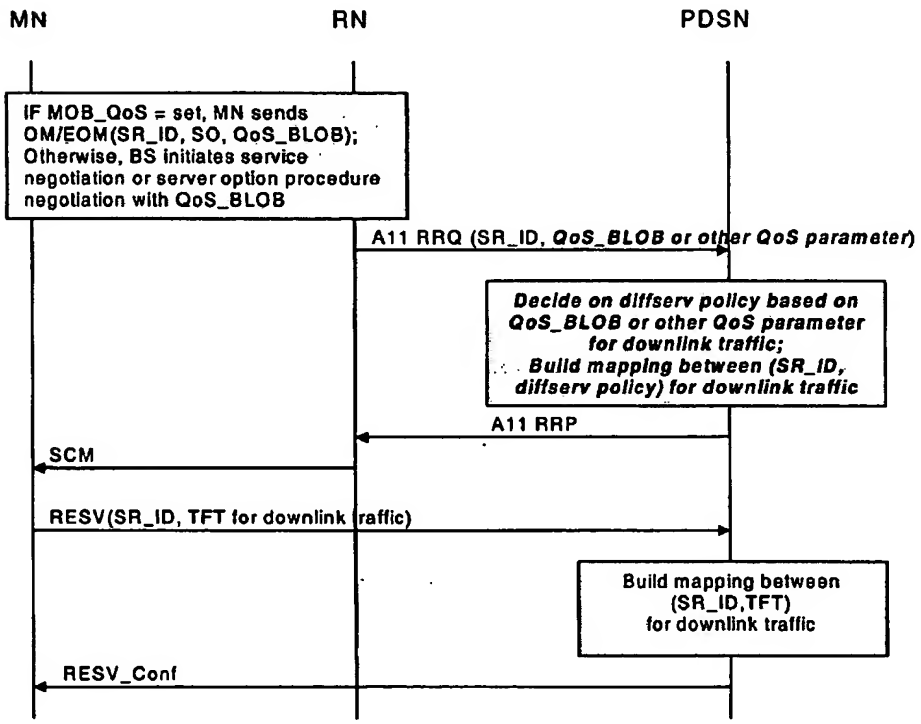

Figure 2. Flow Mapping and DiffServ Conditioning for Downlink Traffic: Solution 1

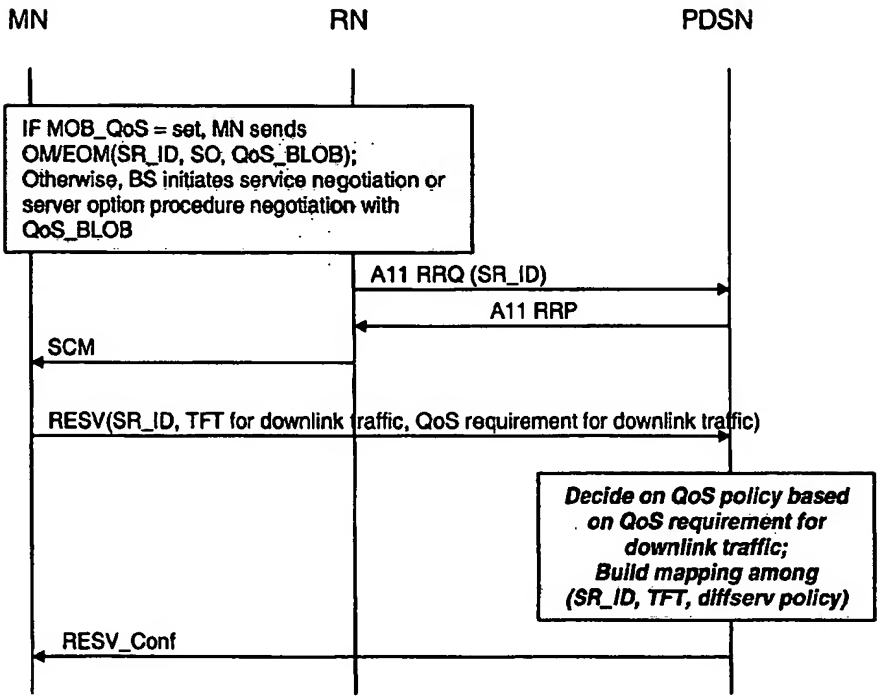

Figure 3. Flow Mapping and DiffServ Conditioning for Downlink Traffic: Solution 2

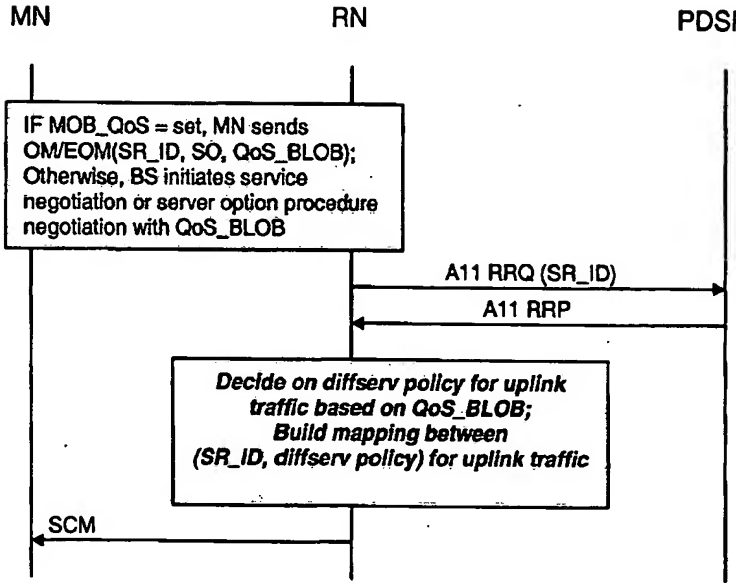

Figure 4. Flow Mapping and DiffServ Conditioning for Uplink Traffic: Solution 1

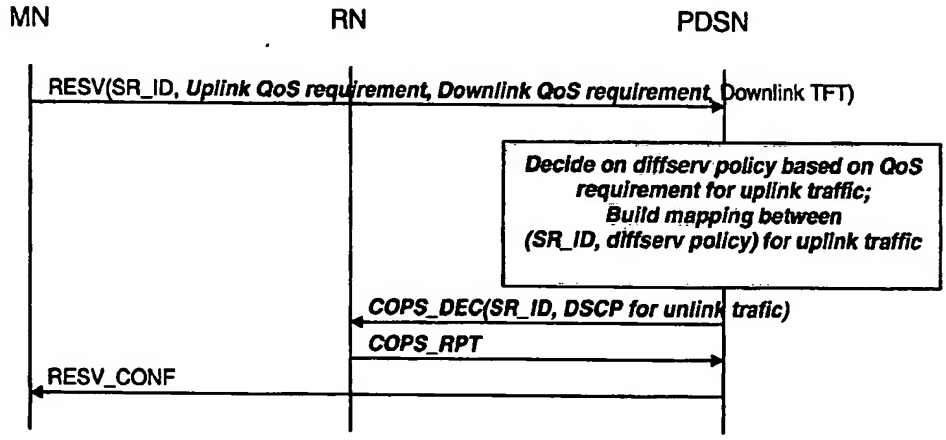

Figure 5. Flow Mapping and DiffServ Conditioning for Uplink Traffic: Solution 2

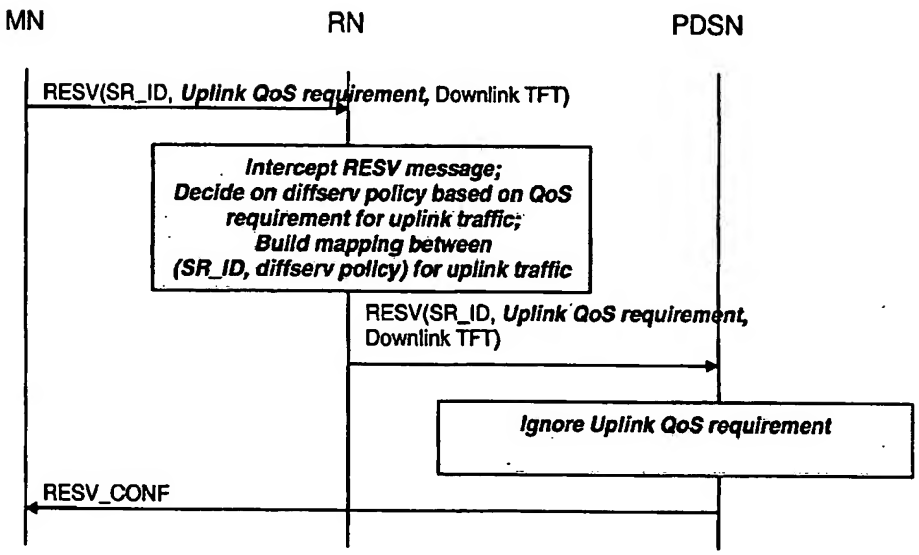

Figure 6. Flow Mapping and DiffServ Conditioning for Uplink Traffic: Solution 3

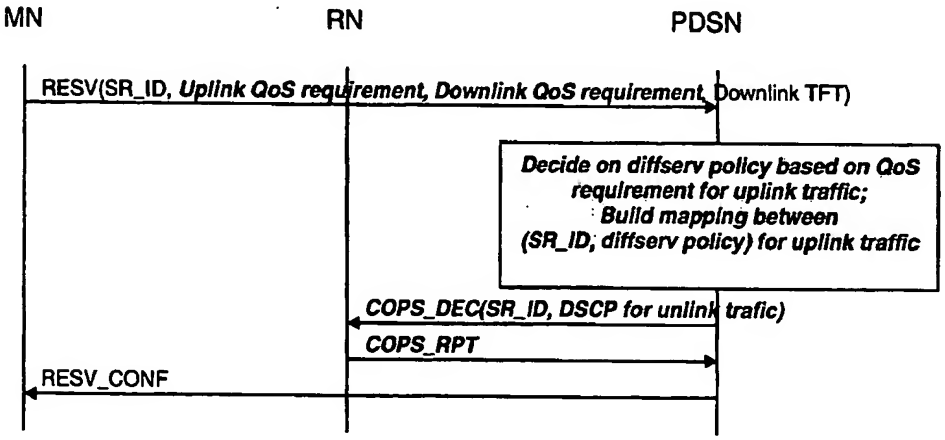

Figure 7. Integration of Solution2/uplink and Solution2/downlink

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